Hand operated winnowers, DIY

Version 1: Hand Operated Winnower

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https://sites.google.com/view/low-tech-farm-tools

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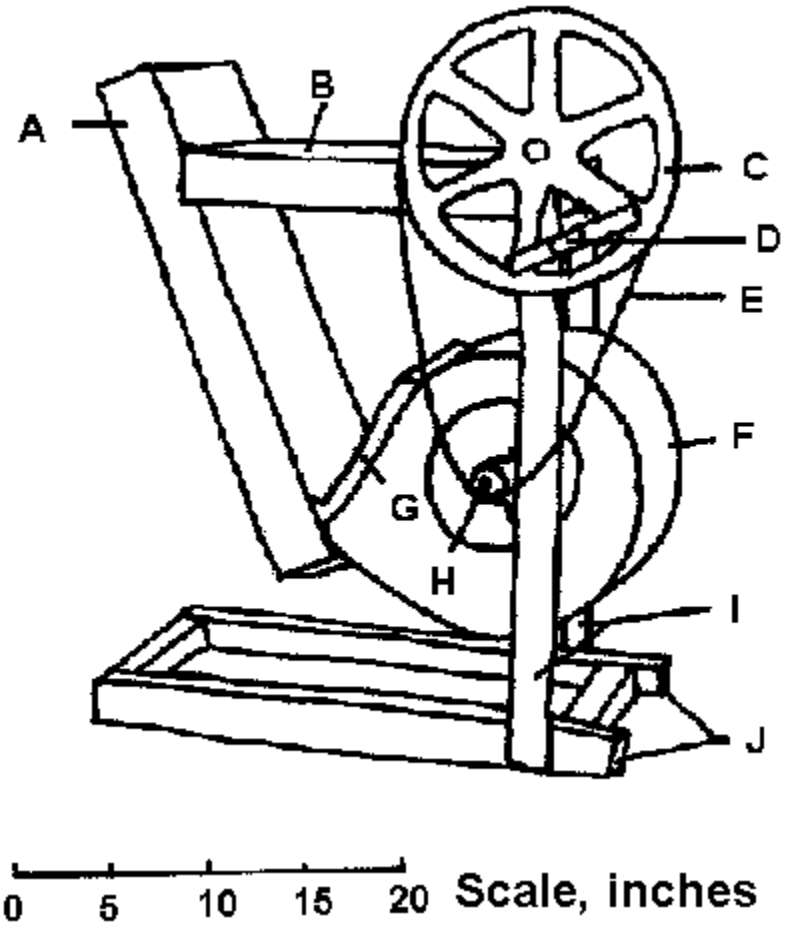

A Rectangular sheet metal air duct, 24 inch long x 10 inch wide x 3-½ inch deep, available from heating and ventilation supply houses.
B Sheet metal tray, make your own.
C Sheave (V- belt pulley), 14-inch diameter, available from WW Grainger (3X943 or 3X942) (1-800-323-0620).
D Crank handle, make your own.
E V-belt.
F Blower with 9-½ inch diameter wheel (4C589) or larger, available form WW Grainger.
G Sheet metal cover and adapter to merger blower (F) with air duct (A).
H Sheave, ½ inch bore, 1 ½ diameter and a pillow block, ½ inch diameter bore
I 1 x 2 inch steel channel or 2 x 4 inch wood upright support.
J 1 x 2 inch steel channel or 2 x 4 inch wood base for winnower.

Operation:

The winnower separates seeds from chaff by blowing the less dense chaff away as seeds fall down a column of air. Place the seed and chaff mixture on the tray (B). Turn the crank handle (D) and push the seed mixture into the air duct (A). Manually adjust the crank speed to provide enough airflow to lift the lighter chaff up and out the top of the air duct, while allowing the denser seeds fall through the bottom of the air duct.

Construction (brief description):

The air duct (A) is purchased from a hardware store. Cut a 2 x 9 inch slot across the air duct, 6 inches from the end. This slot receives the tray (B), and allows seed and chaff on the tray to be introduced into the air duct (A). The tray (B) is made from a 16 x 24 inch, 20-gauge sheet metal. Fold 3 sides up 3 inches and fold the fourth side down 1 inch to make a 10 x 20 inch tray. Trim the fourth side ½ inch from both ends leaving a 9-inch lip that inserts and hooks on to the 2 x 9 inch slot in the air duct (A).

Attach the upright supports (I) to the blower (F) with the blower tilted up 22 degrees, 6 inches off the ground and the axle of the blower wheel is centered on the pillow block/sheave (H). Make base (J). Attach supports (I) to base (J). If supports (I) and base (J) are made from 2 x 4 wood, add diagonal braces (not shown) to strengthen the join. No additional brace is needed if the upright supports (I) and base (J) are 2 inch steel channels welded together. A spacer is attached across the top of the two upright supports (I), (not visible in diagram). The spacer provides bottom support for the tray (B). The 14-inch sheave mounts on to the upright support using a rigid pillow block or two self-aligning pillow blocks, one on each side of the upright support.

Make a sheet metal cover and adapter (G) to merge blower (F) with air duct (A) at 45-degree angle between blower and air duct. A 45-degree air duct elbow can be used as part of the adapter. The sheet metal cover (G) allows a 1-½ inch gap at the bottom of the blower (F) for air to discharge into the air duct (A). Place a ¼ inch mesh screen (not visible in diagram) across the 1-½ inch gap to prevent debris from entering into the blower.

Version 2: Hand operated winnower using bicycle parts

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The large hand operated winnower uses a 16 inch (41 cm) diameter centrifugal blower and bicycle freewheel gear (Figure 1).

Materials to be winnowed are place in the feed tray and push into the chute. Air from blower enters chute at bottom, rises up, lifting lighter chaff and exits chute at top. Seed and more dense material drop out the chute bottom. The blower is elevated to provide suitable feed tray height.

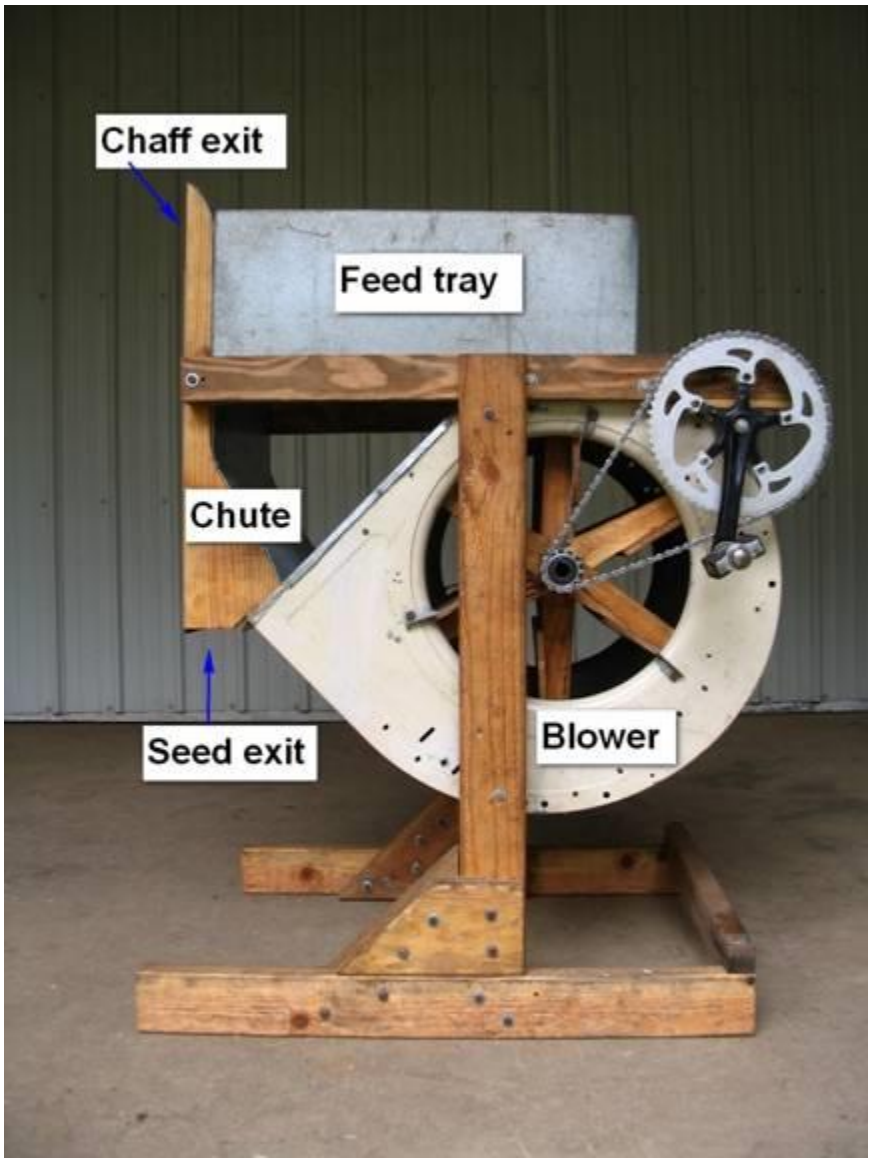


Figure 1. Large hand operated winnower using 16 inch (40.6 cm) diameter blower wheel.

The blower is tilted up at 45 degree angle (Figure 2); a 3 inch (7.6 cm) air deflector inside the chute provides additional upward air deflection (Figure 3 and 4).

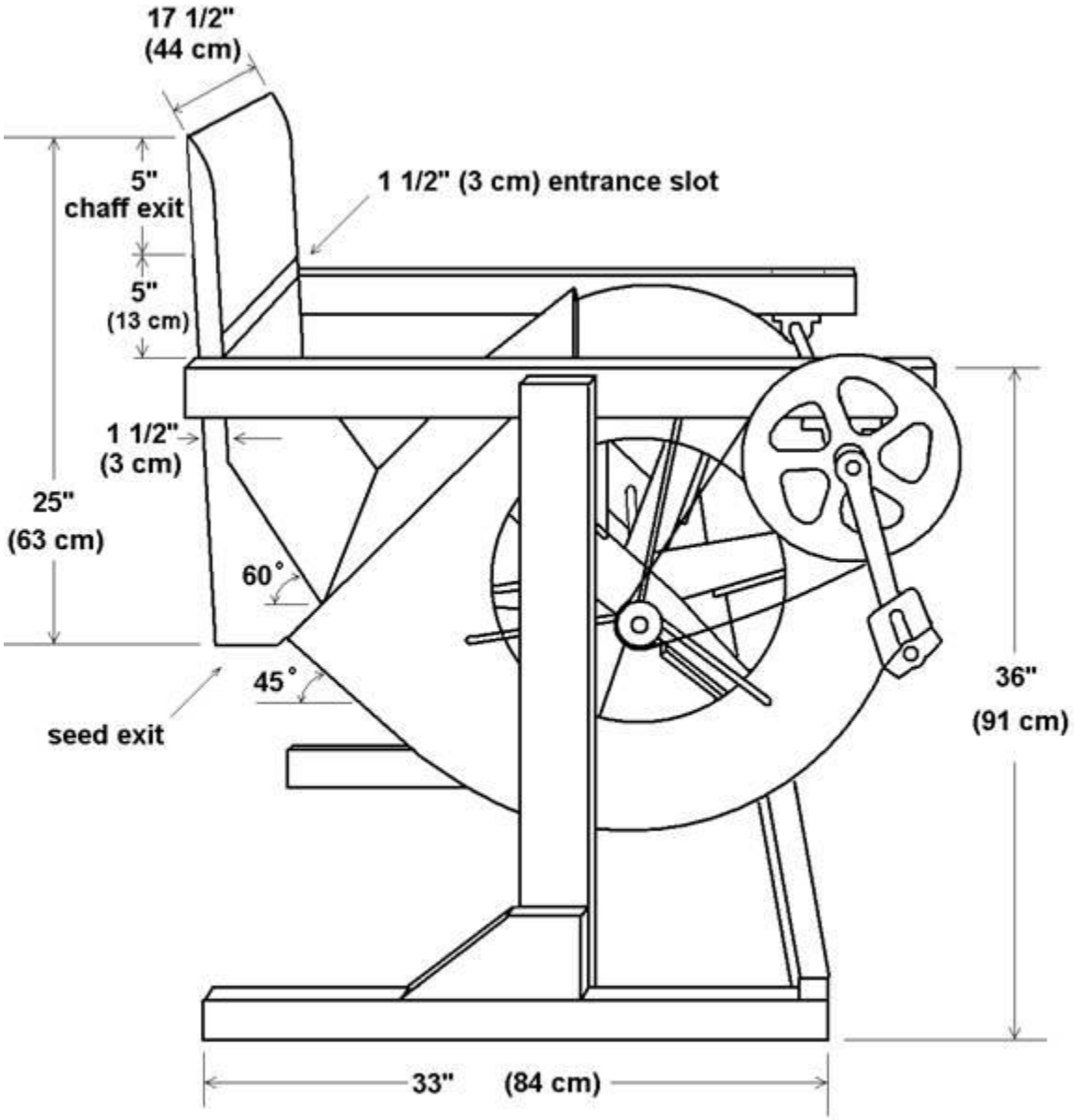


Figure 2. Hand operated winnower shown without feed tray.

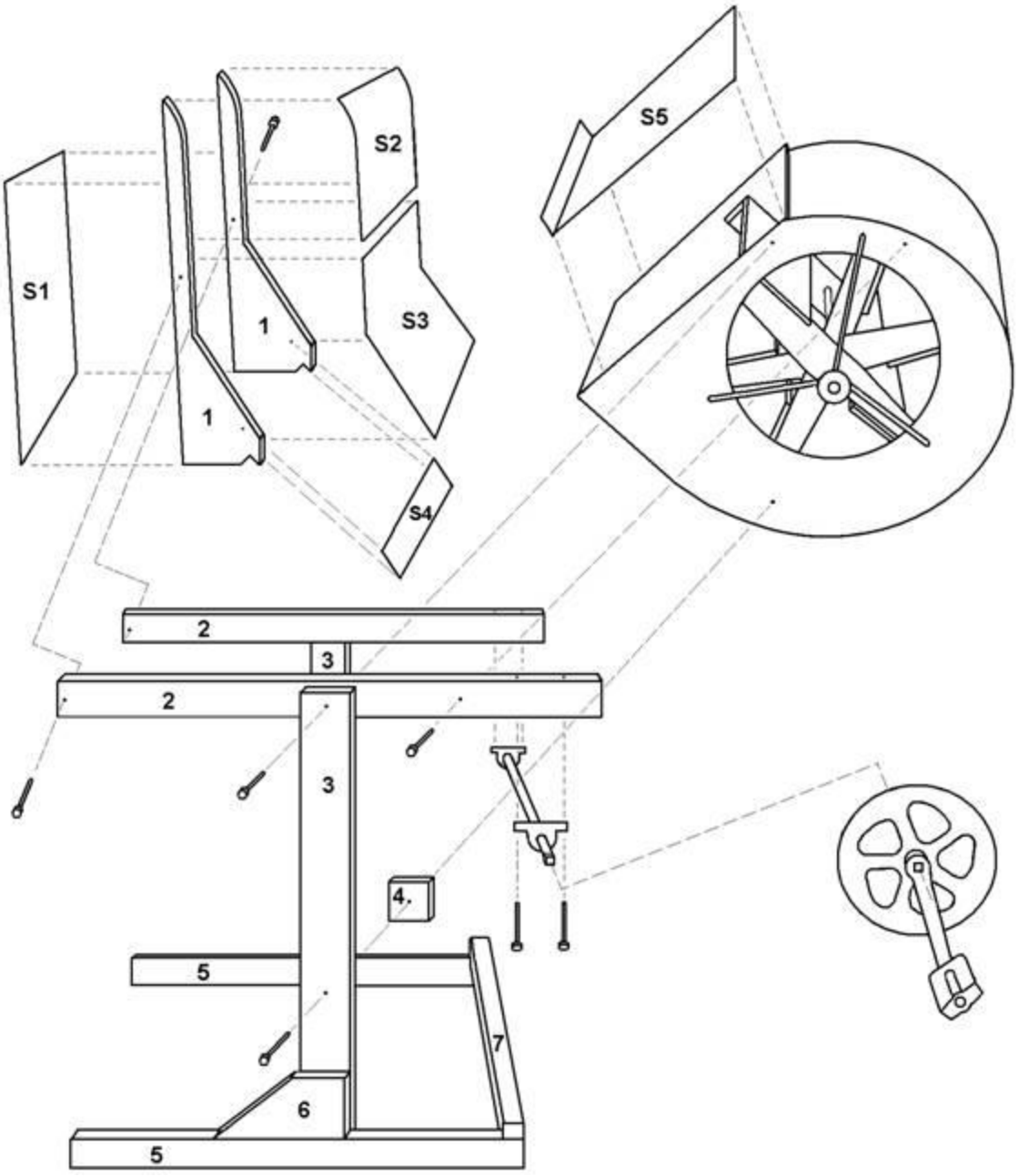


Figure 3. Hand operated winnower, exploded diagram

Materials

Wood support frame, 2x4 inch (5 x 10 cm) lumber; chute side, 1 inch (2.5 cm) board: **1**= chute side; **2**= top tray support; **3**= upright; **4**= spacer (2 required, only 1 shown); **5**= base; **6**= brace (2 required, only 1 shown); **7**= brace

Sheet metals covering the chute are cut from 6 inch (15.2 cm) diameter metal air duct. Unfold, flatten and cut sheet metal to size: **S1**= front chute cover, adjusts hurdle height and chaff exit; **S2**= top chute cover; **S3**= lower chute cover; **S4**= air deflector, directs blower air upward; **S5**= blower cover

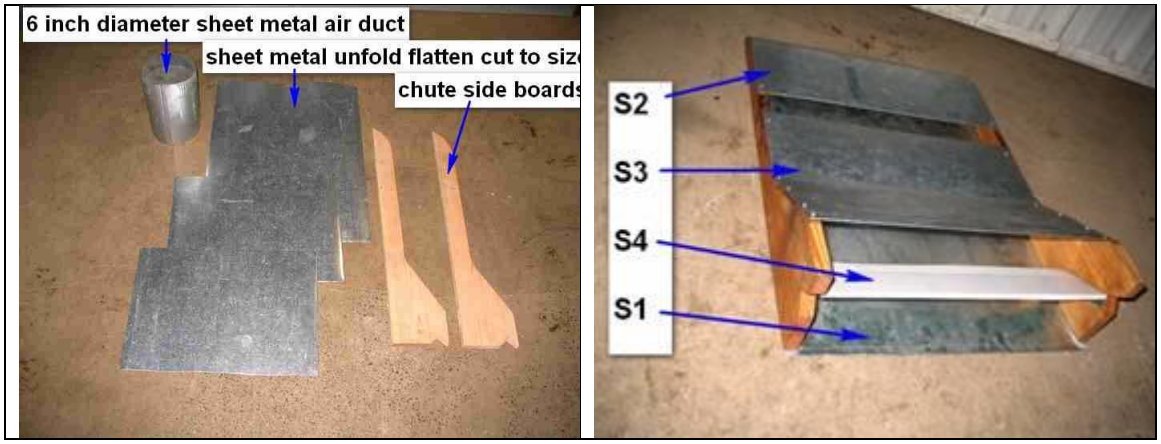
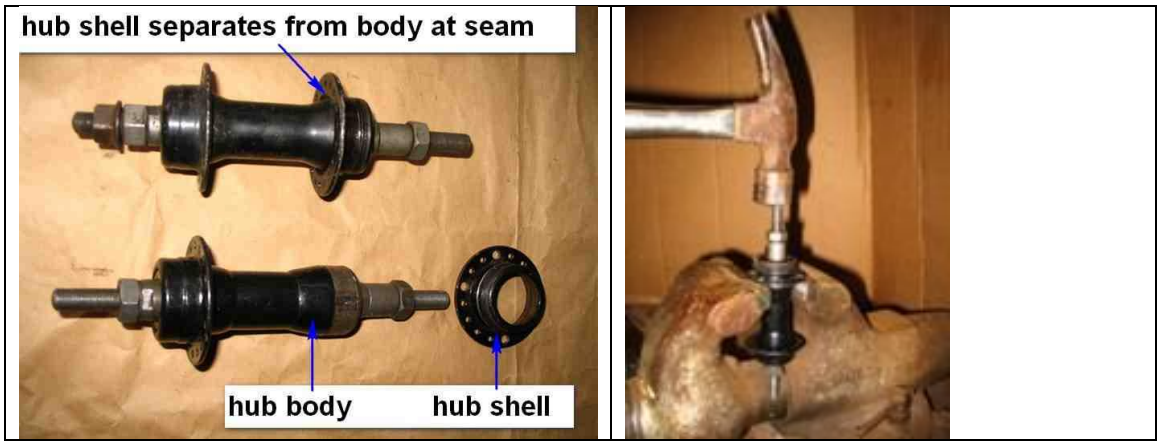


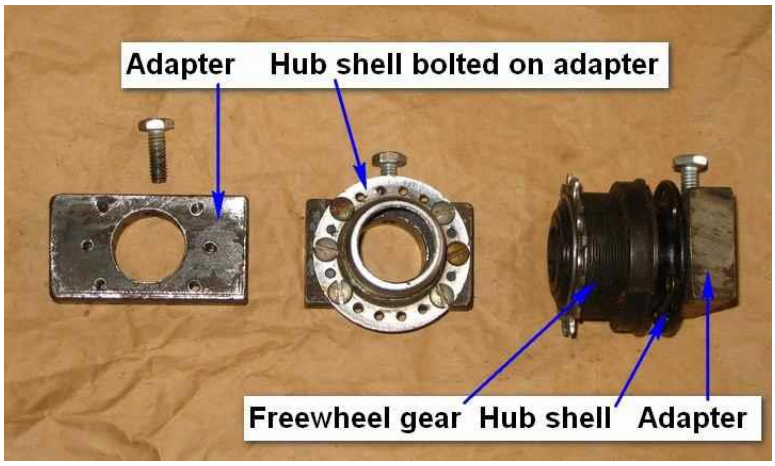
Figure 4. Another view of chute

Gear:

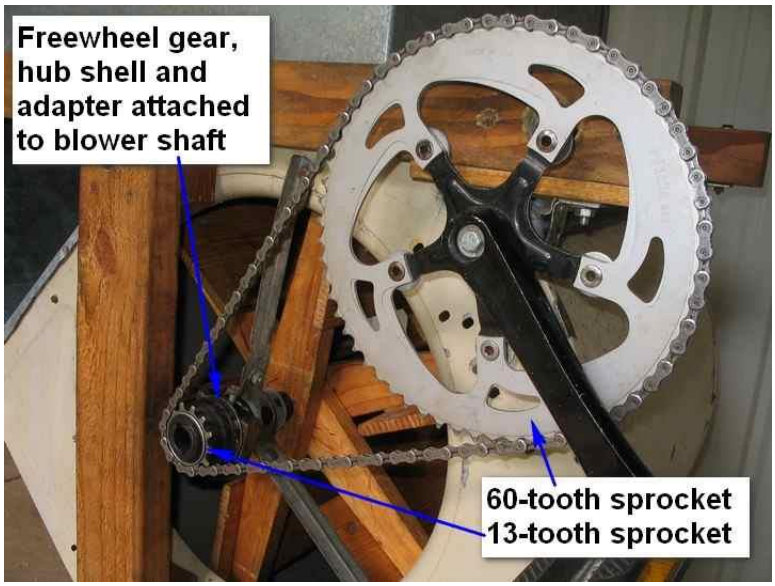
1. Obtain a steel freewheel hub from a 10 speed bicycle. Separate the threaded hub shell from hub body by suspending the threaded hub shell on a vice, and hammer the axle bolt. Aluminum hubs will not work; they are single cast piece and the threaded section will not separate from the hub body.



2. Make a shaft adapter to attach threaded hub shell and freewheel gear to blower shaft. Shown is a 5/8 x 1 ½ x 2 ½ inch (1.6 x 3.8 x 6.3 cm) steel block. Drill a 1 inch (2.5 cm) diameter shaft hole; tap threads to lock adapter to shaft; tap threads to bolt on hub shell.

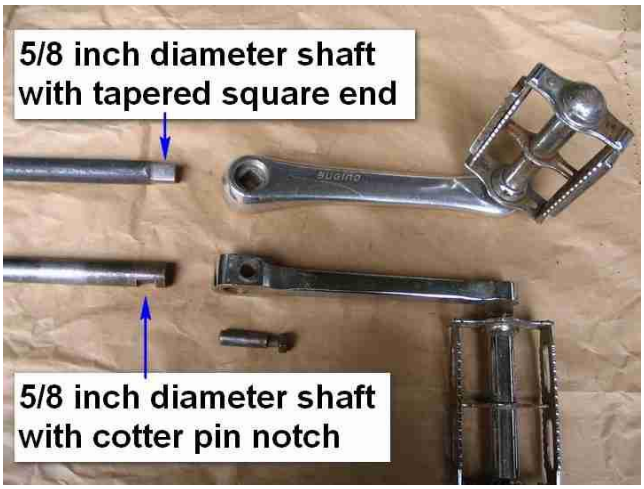


3. Attach a freewheel gear with a high speed, 13-tooth sprocket to threaded hub shell and shaft adapter. Attach this assembly to the blower shaft. Alternative gearing: single speed coaster freewheel gear (BMX). BMX gears have 15 to 17 teeth yielding slower blower wheel rotation than a 13-tooth sprocket per crank rotation.



Hand crank:

1. Attach bicycle pedal crank to a 5/8 inch (1.6 cm) diameter round shaft. Grind a tapered square end on the shaft. Drill and tap threads on the end of the shaft to secure crank arm to shaft. Older style crank arm uses cotter pin. Grind a cotter pin notch on the shaft to secure crank arm to shaft (instead of tapered square end).



2. Use a 60-tooth sprocket (less common) on the crank arm to provide higher blower rotation speed. 52 and 53-tooth sprockets are more common, but provide slower blower rotation speed per crank arm revolution.

Optional:
Replace original steel blower wheel with a wooden wheel. The wooden blower wheel weighs 7 pounds (3.2 kg) and requires less effort to rotate compared to the 13 pound (5.9 kg) metal blower wheel. Large surface area of the wooden blades provides slightly higher air flow, compared to the metal blower wheel. Align all wooden blades square to the shaft and in the same plane.

Reference:
Simple Hand Operated Winnower
Overseas Liaison Department, Technical Bulletin #5, July 1971
National Institute of Agricultural Engineering,
Silsoe, Bedford MK45 4HS England

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